MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2015/2016

TRM2191 – RESOURCE MANAGEMENT TECHNIQUES

(All sections / Groups)

11 MARCH 2016
9.00 a.m – 11.00 a.m
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of 5 printed pages (including cover page).
2. Attempt **ALL FOUR** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the Answer Booklet provided.

You are required to answer <u>ALL FOUR (4)</u> questions.
Show necessary steps to support your answer.

QUESTION 1 (10 MARKS)

(a) *Dee Shrimp Sdn. Bhd.* is supplying frozen shrimps for a local supermarket chain with a minimum quantity of 500 kilograms shrimps per day. It has two types of processors: X and Y. The production capacities and operation costs for the processors are given in the following table.

	Processor X	Processor Y
Production per hour (*kilogram*)	120	50
Operating cost per hour (*RM*)	140	70

Due to limited hours of available technician, processor X can operate no more than 5 hours per day. At least 40% of total production of frozen shrimps per day must be produced from processor X. Formulate a Linear Programming model to determine number of hours per day each processor will operate economically.

[3 marks]

(b) Given below is the initial simplex table of a Linear Programming problem solving by the Big-M method with artificial variable A.

	$C_j \rightarrow$	3	-1	0	0	0	-M
C_B	X_B	x_1	x_2	s_1	s_2	s_3	A
-M	$A=2$	2	1	-1	0	0	1
0	$s_2=3$	1	3	0	1	0	0
0	$s_3=4$	0	1	0	0	1	0
	$Z=-2M$	-2M-3	-M+1	M	0	0	0

(i) In order to maximize the objective function $Z = 3x_1 - x_2$, state the leaving and entering variables for the next iteration of the Big-M method.

(ii) Find the optimum solution.

[1+3=4 marks]

(c) Consider the following Linear Programming (LP) problem:

Maximize profit $Z = 5x_1 + 8x_2$

Subject to: $2x_1 + 3x_2 \leq 60$

$4x_1 + 3x_2 \leq 96$

$x_1, x_2 \geq 0$

Graphically solve the LP problem (use the graph paper provided). Show the feasible region and find the optimal profit.

[3 marks]

Continued ...

QUESTION 2 (10 MARKS)

(a) The table below illustrates a transportation problem. Determine the initial basic feasible solution using the Northwest-corner method.

	Destination			
Source	**1**	**2**	**3**	**Supply**
A	32	60	28	20
B	12	14	12	30
C	33	20	15	45
Demand	30	35	30	

[2 marks]

(b) A fruit juice firm has three plants, *P1*, *P2*, and *P3*, with monthly production of 35, 50 and 40 thousand liters of juice, respectively. Each month the firm must fulfil the needs of its four distribution centers, *C1*, *C2*, *C3* and *C4*, with juice demand of 45, 20, 30 and 30 thousand liters, respectively. Table below indicates the cost (*RM*) for shipping one thousand liters of juice from the three plants to four distribution centers.

	Distribution cost (*RM*) per one thousand liters				
Plant	**C1**	**C2**	**C3**	**C4**	**Supply**
P1	8	6	10	9	35
P2	9	12	13	7	50
P3	14	9	16	5	40
Demand	45	20	30	30	

Given the initial basic feasible solution $x_{11}=35$, $x_{21}=10$, $x_{22}=10$, $x_{23}=30$, $x_{32}=10$ and $x_{34}=30$, where x_{ij} denotes the shipping quantity (in units of one thousand liters) from plant i to distribution center j. Determine the monthly shipping schedule that minimize the transportation cost.

[4 marks]

(c) An operation director of a company must assign four staffs, *Yusuf*, *Faruk*, *Jenet* and *Katren* to manage four new regional offices: I, II, III and IV. The staffs are all equally qualified so the decision will be based on the costs of relocating the staffs. The relocation cost (in units of RM1000) is presented in the following table.

	Relocation cost (RM1000)			
Staff	**I**	**II**	**III**	**IV**
Yusuf	14	5	8	7
Faruk	2	12	6	5
Jenet	7	8	3	9
Katren	2	4	6	10

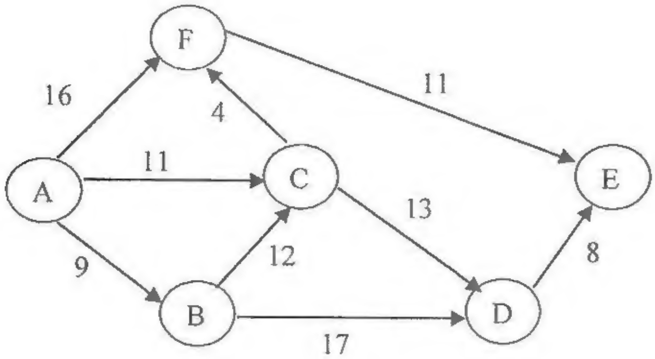
Determine the assignment of the staffs to new offices that minimize the relocation costs.

[4 marks]

Continued ...

QUESTION 3 (10 MARKS)

(a) The following network shows the travelling cost (*RM*) for a person to travel by a taxi between 6 locations in Kota Bharu.



By Dijkstra's algorithm, find a route that minimize the travelling cost between locations *A* and *E*.

[4 marks]

(b) The following table represents a project with known activity times. All times are in weeks.

Activity	Predecessor(s)	Duration (weeks)
A	-	4
B	-	2
C	-	4
D	A, B	3
E	D	5
F	E	3
G	C	1
H	F, G	3
I	H	6

(i) Draw a project network based on the given information.
(ii) Determine the earliest and latest activity times for each activity.
(iii) State the critical path(s) and project completion time.
(iv) What happen to the project completion time if the duration of activity *E* increases by 3 weeks? Explain your answer.

[2+2+1+1=6 marks]

Continued ...

QUESTION 4 (10 MARKS)

(a) Suppose a shop sells 550 units of a product per week. It costs the shop RM0.05 for keeping a product in store for one week. The setup cost is RM40 per order. Assume that demand occurs at a constant rate and shortages are not allowed.

(i) Find the optimum ordering quantity and ordering cycle length.
(ii) With optimum ordering quantity from (i), compute the total cost per unit time (TCU).

[1+1 = 2 marks]

(b) Given the function

$f(x_1, x_2) = -3{x_1}^2 - x_1 x_2 - 5{x_2}^2$.

(i) Find all the *2nd* order partial derivatives of $f(x_1, x_2)$ with respect to x_1 and x_2.
(ii) State the Hessian matrix of $f(x_1, x_2)$.
(iii) Determine whether function $f(x_1, x_2)$ is convex, concave or neither. Explain your answer.

[1+0.5+1=2.5 marks]

(c) Given a maximization problem:

Maximize $f(x_1, x_2) = 2x_1 - {x_1}^2 + 4x_2 - {x_2}^2$
Subject to: $x_1 + x_2 \leq 1$
$x_1, x_2 \geq 0$

Use the following Kuhn-Tucker conditions to solve the problem.

i. $\dfrac{\partial f}{\partial x_j} - \lambda \dfrac{\partial h}{\partial x_j} = 0$
ii. $\lambda h = 0$
iii. $h \leq 0$
iv. $\lambda \geq 0$

[5.5 marks]

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